R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE SPECIFICATION

The specification has been amended to correct a spelling error of which the undersigned has become aware, as well as to remove some unnecessary discussion of prior art. In addition, the disclosure/summary of the invention has been amended to better accord with the amended independent claim 1.

No new matter has been added, and it is respectfully requested that the amendments to the specification be approved and entered.

THE CLAIMS

Claim 1 has been amended to recite that the image processing unit comprises an image identification calculating unit which calculates grade data to be used to determine a grade of a color of the subject based on the subject spectroscopic images stored in the image memory unit.

In addition, claims 2-16 have been canceled, and new claims 17-35 have been added. The new claims all depend directly or indirectly from claim 1, and it is noted that new claims 24-32

recite subject matter previously set forth in now canceled

claims 4, 5, 7-12 and 16.

No new matter has been added, and it is respectfully

requested that the amendments to the claims be approved and

entered.

THE PRIOR ART REJECTIONS

Claims 1-16 were all rejected under 35 USC 103 as being

obvious in view of various combinations of USP 6,201,880 ("Elbaum

et al"), USP 5,690,486 ("Zigelbaum"), USP 5,503,559 ("Vari"),

USP 7,144,248 ("Irwin "), and USP 6,306,421 ("Kunz"). These

rejections, however, are respectfully traversed with respect to

the claims as amended hereinabove.

The present invention as recited in amended independent

claim 1 is directed to an image processing system including an

image capturing unit and an image processing unit. The image

capturing unit includes an image pick-up optical system which

picks-up an image of a subject, an image pick-up device unit

which obtains a subject signal from the subject, a plurality of

illuminating light sources with different characteristics of

spectroscopic distributions, and a photographing operating unit

which performs an image photographing operation. The image

capturing unit interlocks the illuminating light sources with an

exposure timing of the image pick-up device unit, selectively

lights-on the illuminating light sources, and obtains a plurality of subject spectroscopic images. The image processing unit includes an image memory unit which stores the subject spectroscopic images photographed by the image pick-up unit and calculates a desired image based on the image signal stored in the image memory unit. In addition, as recited in amended independent claim 1, the image processing unit includes an image identification calculating unit which calculates grade data to be used to determine a grade of a color of the subject based on the subject spectroscopic images stored in the image memory unit.

For example, as disclosed in the specification, the image determining and calculating unit 34 of the processing apparatus 2A analyzes the spectroscopic image data to obtain grade data, e.g., data about the tone of the color of the tooth of the patient 59, when the tooth is the subject as in dental applications of the invention (see page 82, line 17 to page 83, line 2 with reference to Fig. 13). The grade data is used for a shading guide for comparing the tone of the tooth color. And since the tone of the tooth color is thus determined based on the spectroscopic images, there are no personal, subjective influences when determining the proper color of a false tooth to match to natural teeth.

It is respectfully submitted that the cited prior art references do not disclose, teach or suggest calculating grade

-17-

data to be used to determine a grade of a color of a subject
based on spectroscopic image data derived from spectroscopic
images of the subject.

Elbaum et al discloses a method and apparatus for imaging
teeth in which a camera obtains black and white images of teeth
and one or more computer-calculated numerical measures of
selected properties of the images are calculated and displayed on
a monitor (see column 13, lines 37-44). Elbaum et al also
provides visually enhanced representations that help the dentist
diagnose the condition of the tooth. The image modifications to
enhance the representations include wavelet amplitude, phase-
representations, iso-intensity contours, and line scan profiles
(see column 13, lines 8-14). Elbaum et al also includes a
digital processing unit which compares a current image of a tooth
to a previously obtained image of the same tooth to identify
changes in the tooth over time using for example, numerical
correlation (see column 3, lines 44-52).

In contrast to the claimed present invention, however,
Elbaum et al does not disclose any structure which obtains a
plurality of subject spectroscopic images (i.e., spectroscopic
images of the tooth), nor any structure which then calculates
grade data used to determine the grade of the color of the tooth
based thereon. And it is respectfully submitted that the
computer-calculated numerical measures of the selected properties

-18-

and visually enhanced representations of Elbaum et al are not
comparable to the calculated grade data of the claimed present
invention because they do not have the same purposes as grade
data and are also not based on spectroscopic images.

Zigelbaum discloses a device which detects the color of a
damaged tooth and automatically determines the proper restorative
dental material to be used to repair the damaged tooth. The
device includes red, green and blue LEDs 44-46 which are
sequentially lit-on and a comparator 70 which compares a color
signal value, generated by a photodetector 52 which receives
light reflected from the damaged tooth via a wand 24, to a
plurality of reference color signal values. The reference color
signal value having the best match to the reflection light is
provided as output indicative of the color of the restorative
material (column 3, line 65 to column 4, line 11). Processor 92
therefore determines a restorative material that best matches the
color of the tooth (column 4, line 60 to column 5, line 1).

In contrast to the claimed present invention, however, the
device of Zigelbaum does not include any structure which obtains
a plurality of spectroscopic images by interlocking a plurality
of illuminating light sources with an exposure timing of an image
pick-up device unit and selectively lighting-on a plurality of
illuminating light sources. Rather, Zigelbaum receives
reflections of light which are compared to reference signal

-19-

values without forming images therefrom. Therefore, Zigelbaum
also does not disclose, teach or suggest any structure which
calculates grade data used to determine the grade of the color of
the tooth based on spectroscopic images.

   Accordingly, it is respectfully submitted that Elbaum et al
and Zigelbaum (and Vari, Irwin and Kunz) do not disclose, teach
or suggest an image capturing unit or other structure which
obtains a plurality of spectroscopic images and an image
processing unit or other structure which calculates grade data
used for determining a grade of the color of the subject of the
spectroscopic images based thereon, as according to the present
invention as recited in amended independent claim 1.

   It is respectfully submitted, moreover, that the cited prior
art references also do not disclose, teach or suggest many of the
other features recited in the dependent claims. For example, the
cited prior art references do not disclose, teach or suggest that
the grade data indicates a grade of a shading guide for comparing
the color of a tooth as the subject (as set forth in new claim 17)
or that an image capturing unit includes an abutting portion
formed in a cylindrical shape which abuts on the subject (as set
forth in new claim 22). In addition, the cited prior art
references do not disclose an image capturing unit which includes
distance measuring means which manages the size of the subject in
the photographed image, or the other claimed features of the
distance measuring means (as set forth in new claims 32-35).

In view of the foregoing, it is respectfully submitted that amended independent claim 1 and new claims 17-35 depending therefrom clearly patentably distinguish over all of the cited prior art references, taken in any combination consistent with the respective fair teachings thereof, under 35 USC 103.

RE: PRIORITY CLAIM

It is respectfully pointed out that priority of Japanese application 2002-218864 was properly claimed in the Declaration filed with the original application papers. In particular, see page 2 of the Declaration.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

                          Respectfully submitted,

                          /Douglas Holtz/

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